University of Connecticut
Department of Mathematics

MATH 1071 PRACTICE EXAM 2 FALL 2016

NAME: _____

Instructor Name: _____ Section: _____

Read This First !

- Please read each question carefully. Show **ALL** work clearly in the space provided. In order to receive full credit on a problem, solution methods must be complete, logical and understandable.
- Answers must be clearly labeled in the spaces provided after each question. Please cross out or fully erase any work that you do not want graded. The point value of each question is indicated after its statement. No books or other references are permitted.
- Calculators are allowed, however models TI-89 and above are not permitted.

- **This practice exam is just a guide to prepare for the actual exam. It may take more or less time to take than the actual exam. Questions on the actual exam may or may not be of the same type, or nature. Do not prepare only by taking this exam. You should also review class notes, WebAssign, and in class quizzes.**

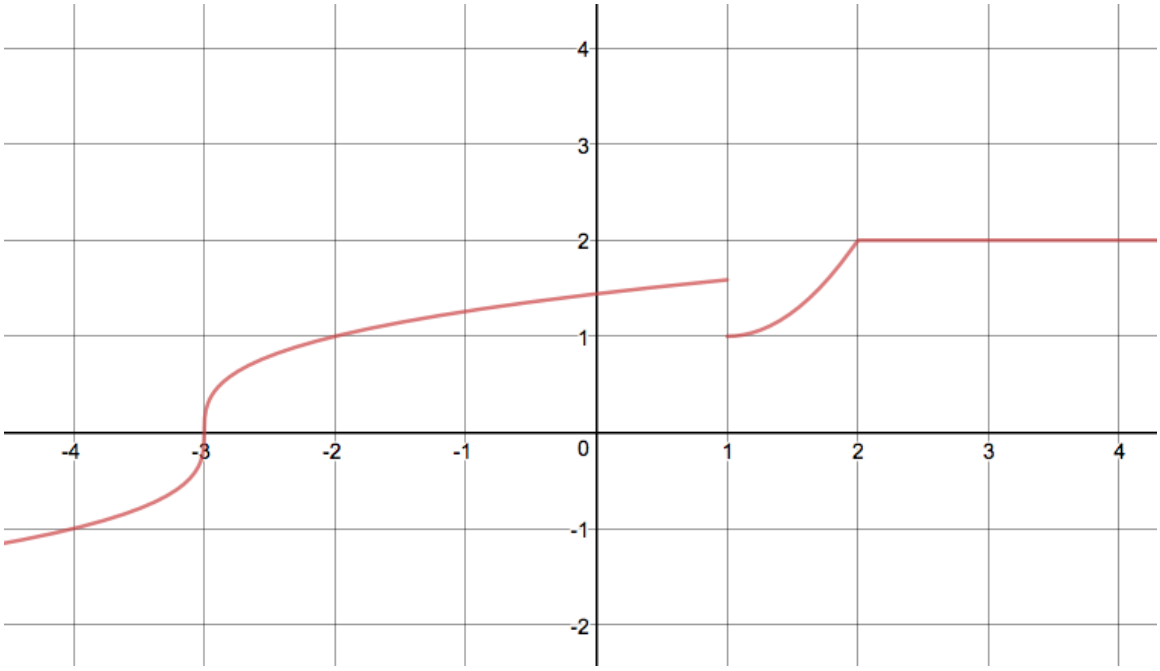
1. Use the limit definition of derivative to determine the derivative of the following function. **No credit will be given for any other method.**

$$f(x) = \frac{3}{2x - 9}$$

2. Use the limit definition of derivative to determine the derivative of the following function. **No credit will be given for any other method.**

$$f(x) = 2x^2 - x$$

3. The graph of $f(x)$ is shown below. Specify the x-values where $f(x)$ is not differentiable.



4. Let $f(x) = x^9 + 8x^2$. Find the equation of the tangent line at $x = 1$.

5. Let $h(x) = \dfrac{4}{x}$. Find the equation of the tangent line at $x = -2$.

6. Compute the derivatives of the following functions

(a) $f(x) = 2x^3 + 5x^7 + 11x^{13}$

(b) $g(x) = 3\ln x + \frac{x^2}{3} + 2$

(c) $f(x) = x + 2x^2 + 3x^3$

(d) $h(x) = x^{3/2} + e^x$

(e) $f(x) = (x^2 + 1)e^x$

(f) $h(x) = \sqrt{x}\ln x$

(g) $g(x) = \frac{x}{\ln x}$

(h) $h(x) = e^x \ln x + 5$

(i) $g(x) = \dfrac{x^2}{(x^3 + x^4)^2}$

(j) $h(x) = (x + 2)\ln x$

(k) $f(x) = (x + 1)^{2016}$

(l) $h(x) = (e^x + x)^5$

(m) $g(x) = (5x + e^x)^{11}$

(n) $f(x) = (x^3 + 2x - 8)^5$

(o) $g(x) = \dfrac{1}{(x^3 + 4x)^4}$

(p) $f(x) = (x^2 + \frac{x^3}{3})^{23}$

(q) $g(x) = (\ln x + 20)^{16}$

(r) $f(x) = e^{7x^2-5}$

(s) $g(x) = 3^{4x^3+x}$

(t) $h(x) = 5^{x^2+10}$

(u) $f(x) = \ln(3x^2 + x)$

(v) $h(x) = \log_3(2x^4 - x)$

(w) $f(x) = \log|x^{-1}|$

7. Let $f(x) = \dfrac{x+5}{x^2}$.

   (a) Find the critical values of f if any. If there are no critical values any write "none", but be sure to show all work.

   (b) State in interval notation the x values for which $f(x)$ is increasing. Show all work.

   (c) State in interval notation the x values for which $f(x)$ is decreasing. Show all work.

8. Suppose that the domain of $g(x)$ is all real numbers. The first derivative of $g(x)$ is

$$g'(x) = x^4 - x^2.$$

   (a) Find the critical values of g if any. If there are no critical values any write "none", but be sure to show all work.

   (b) State in interval notation the x values for which $g(x)$ is increasing. Show all work.

   (c) State in interval notation the x values for which $g(x)$ is decreasing. Show all work.

9. Let $f(x) = x^4 + 2x^3 - 12x^2 + 10$.
   (a) Give the intervals where $f(x)$ is concave up and the intervals where $f(x)$ is concave down.
   (b) Find the x-coordinates of the inflection points for $f(x)$.

10. Suppose the function $g(x)$ has a domain of all real numbers except $x = 4$. The second derivative of $g(x)$ is
$$g''(x) = \frac{x^2 + 7x + 10}{(x-4)^2}.$$
   (a) Give the intervals where $g(x)$ is concave up and the intervals where $g(x)$ is concave down.
   (b) Find the x-coordinates of the inflection points for $g(x)$.

11. Find the horizontal asymptote(s) of the function, if any exist.

(a) $f(x) = \dfrac{16x^2 + 3x^2 + 6}{5x^3 + 6x^2 + 2}$.

(b) $g(x) = \dfrac{x^3 + 3x^2}{6x^3 + x}$.

(c) $h(x) = \dfrac{21 + 4e^{4x}}{7 + 2e^{4x}}$.

12. Sketch the graph of a curve with the following properties. Label all relative extrema and inflection points

- $f(-3) = 1$, $f(3) = 1$, $f(5) = -1$,
- $\lim_{x\to -1^-} f(x) = \infty$, $\lim_{x\to -1^+} f(x) = -\infty$, $\lim_{x\to -\infty} f(x) = -\infty$, $\lim_{x\to \infty} f(x) = -10$
- $f'(3) = 0$
  - $f'(x) < 0$ for all $x > 3$
  - $f'(x) > 0$ for all $x < -1$ and $-1 < x < 3$
- $f''(-3) = 0$, $f''(5) = 0$
  - $f''(x) < 0$ for all $x < -3$ and $-1 < x < 5$,
  - $f''(x) > 0$ for all $-3 < x < -1$ and $x > 5$

13. Sketch the graph of a curve with the following properties. Label all relative extrema and inflection points

- $f(-5) = 1$, $f(-3) = -1$, $f(3) = -1$,
- $\lim_{x\to 1^-} f(x) = \infty$, $\lim_{x\to 1^+} f(x) = -\infty$, $\lim_{x\to -\infty} f(x) = 10$, $\lim_{x\to \infty} f(x) = \infty$
- $f'(-3) = 0$, $f'(x)$ does not exist at $x = 1$.
  - $f'(x) < 0$ for all $x < -3$
  - $f'(x) > 0$ for all $-3 < x < 1$ and $x > 1$
- $f''(-5) = 0$, $f''(3) = 0$, $f''(x)$ does not exist at $x = 1$.
  - $f''(x) < 0$ for all $x < -5$ and $1 < x < 3$,
  - $f''(x) > 0$ for all $-5 < x < 1$ and $x > 3$

14. Let $f(x) = x^4 + 8x^3 + 18x^2$. Sketch a graph of the curve using the following procedure. Label all relative extrema and inflection points.
    (a) Find the domain of $f(x)$.
    (b) Find the x-intercept(s) and y-intercept of $f(x)$.
    (c) Find the horizontal and vertical asymptotes of $f(x)$.
    (d) Find $f'(x)$ and use it to determine intervals of increasing/decreasing and local extrema.
    (e) Find $f''(x)$ and use it to determine intervals of concavity and inflection points.
    (f) Sketch the graph of $f(x)$.

15. Let $f(x) = \dfrac{x}{x^2 - 4}$. Sketch a graph of the curve using the following procedure. Label all relative extrema and inflection points.
    (a) Find the domain of $f(x)$.
    (b) Find the x-intercept(s) and y-intercept of $f(x)$.
    (c) Find the horizontal and vertical asymptotes of $f(x)$.
    (d) Find $f'(x)$ and use it to determine intervals of increasing/decreasing and local extrema.
    (e) Find $f''(x)$ and use it to determine intervals of concavity and inflection points.
    (f) Sketch the graph of $f(x)$.